

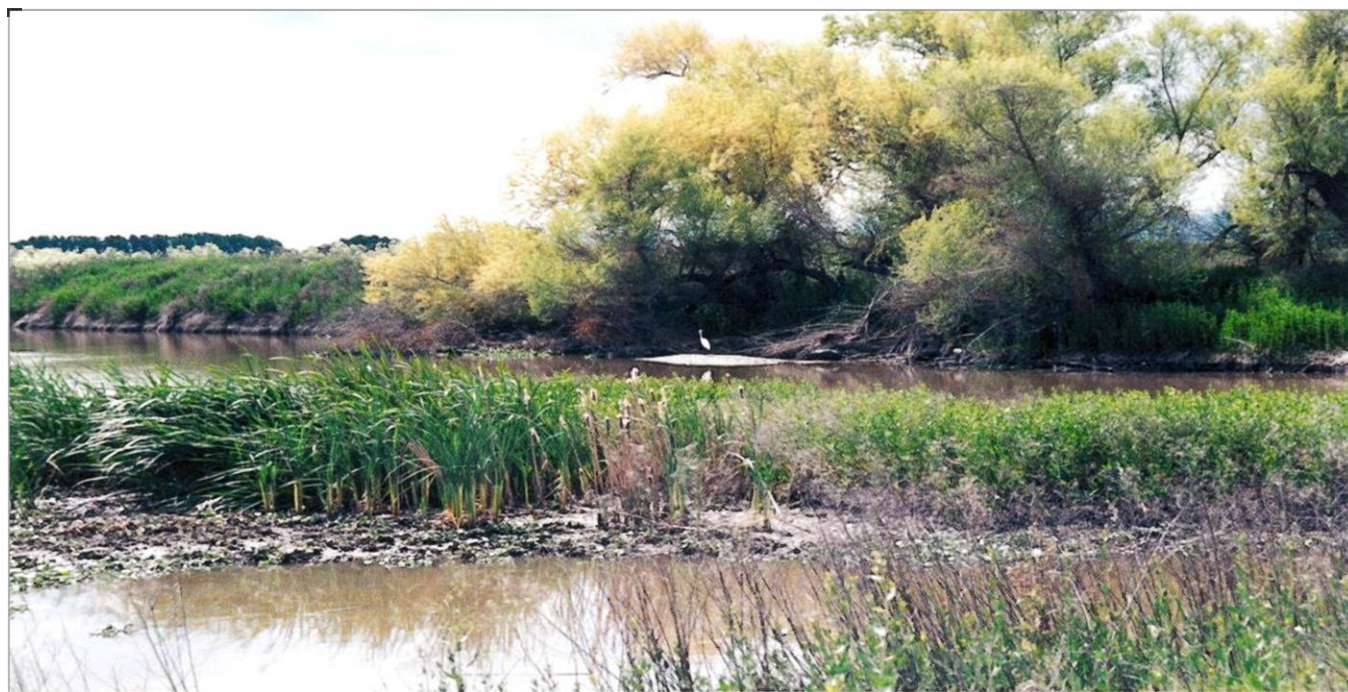
RECLAMATION

Managing Water in the West

In compliance with the “Management Agency Agreement between the Central Valley Regional Water Quality Control Board and the United States Bureau of Reclamation” executed on December 4, 2014

Annual Work Plan, FY 2019

October 1, 2018 – September 30, 2019



Bureau of Reclamation
Mid-Pacific Region

August 2018

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

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Abbreviations and Acronyms

Action Plan	Actions to Address the Salinity and Boron TMDL Issues for the Lower San Joaquin River, July 9, 2008 (Updated November 2010)
Basin Plan	1994 Water Quality Control Plan for the Sacramento and San Joaquin River Basins, 4 th Edition, updated April 2016
CALFED	California Bay-Delta Authority
CDEC	California Data Exchange Center
CESU	Cooperative of Ecosystem Studies Unit
CVP	Central Valley Project
CV Water Board	Central Valley Regional Water Quality Control Board
CV-SALTS	Central Valley Salinity Alternatives for Long-Term Sustainability Stakeholder Group
D-1641	State Water Resources Control Board Revised Water Right Decision 1641
DMC	Delta-Mendota Canal
DWR	California Department of Water Resources
EC	electrical conductivity
GBP	Grassland Bypass Project
GOES	geostationary operational environmental satellites
GEA	Grassland Ecological Area
GWD	Grassland Water District
LBNL	Lawrence Berkeley National Laboratory
LSJR	Lower San Joaquin River
MAA	management agency agreement
MID	Modesto Irrigation District
MOU	memorandum of understanding
NOAA	National Oceanic and Atmospheric Administration

NWIS	National Water Information System
PID	Patterson Irrigation District
PTMS	Program to Meet Standards
QA	quality assurance
Reclamation	United States Bureau of Reclamation
RFC	River Forecasting Center
RTMP	real-time management program
SJR	San Joaquin River
SJVDA	San Joaquin Valley Drainage Authority
State Water Board	State Water Resources Control Board
TID	Turlock Irrigation District
TMDL	total maximum daily load
TRT	technical research team
USGS	United States Geological Survey
uS/cm	Micro Siemens Per Centimeter
WARMF	Watershed Analysis Risk Management Framework
WSID	West Stanislaus Irrigation District
WSJRW	Westside San Joaquin River Watershed Coalition
WQOs	water quality objectives

Purpose

The Central Valley Regional Water Quality Control Board's (CV Water Board) Salt and Boron Total Maximum Daily Load (TMDL) for the Lower San Joaquin River (LSJR) was approved and placed into effect on July 28, 2006. In response to the Salt and Boron TMDL, United States Bureau of Reclamation (Reclamation) drafted a memorandum entitled "Actions to Address the Salinity and Boron TMDL Issues for the Lower San Joaquin River", dated July 9, 2008, and updated in November 2010 (Action Plan). Reclamation subsequently entered into a management agency agreement (MAA) with the CV Water Board on December 22, 2008. The Action Plan was created to accompany the MAA and provide details about Reclamation's planned activities to comply with the TMDL-based water quality control plan objectives. Most initial activities were scientific in nature and intended to improve understanding of the Basin, characterize salt loading from the seven individual subbasins defined in the TMDL and identify future salt load reduction and schedule coordination projects. An early study example was the Delta-Mendota Canal (DMC) Recirculation Project, which evaluated the feasibility of recirculating water from the DMC to the San Joaquin River (SJR) and back into the DMC when necessary to increase flow and reduce the salinity concentration along certain reaches of the River. The project was not deemed a success and worth continuing due to potential negative impacts on Delta fisheries. The Project also had the potential to cause short-term (less than 30 days) excursions above the salinity water quality objective at Vernalis. However, the coordination that was undertaken to realize the study and the monitoring initiated to measure potential flow and water quality impacts have been valuable in guiding the real-time water quality management program. The failure to meet flow and water quality targets at Vernalis were in-part due to the lack of coordination with downstream agricultural diverters who ramped up pumping unexpectedly during one of the experimental release periods. This has helped to guide ongoing coordination efforts and led to the development of the current Watershed Analysis Risk Management Framework (WARMF)-Online web portal.

Reclamation has partnered with Grassland Water District (GWD) over the last 15 years to determine the capabilities of State, Federal and private wetland entities to adjust wetland drainage scheduling to benefit water quality conditions in the SJR. The studies undertaken to date have helped to characterize the hydrology of the Grassland Ecological Area (GEA) – a subarea within the Basin that contains the State, Federal and private wetland entities and advocates for coordinated actions. The studies have financed the design and deployment of real-time flow and electrical conductivity (EC) monitoring stations together with new protocols for conducting real-time data quality control using tools such as the WISKI hydrologic data management system and new data visualization capabilities – first using the web-based platform YSI-EcoNET and more recently the HydroVu platform developed by InSITU Inc. GIS maps of the GEA have been developed and used as backdrops for the sensor network to enhance use and interpretation of the real-time flow and EC data. These activities have not only benefited the real-time water quality management program but also GWD itself by enabling water conservation practices within the District by improving the accuracy of water accounting. Accurate water accounting is the most important first step in wetland salinity management – since good flow measurement is the most difficult measurement to make in the field. GWD has become an exemplar for real-time best management practices in the GEA. GWD is now a party to the "Memorandum of Understanding (MOU) for Participation in the Real Time Management

Program for Meeting the Objectives of the Salt and Boron Total Maximum Daily Load for the Lower San Joaquin River.”

A Reclamation compliance plan (dated May 2010) and compliance report (dated May 2010) were also written to provide the methodology used for the activities described in the Reclamation Action Plan. These documents contain information regarding the technical analysis, computation, and methodology utilized for each Reclamation activity. The 2008 MAA was updated in December 2014 (hereafter called the Updated MAA) consistent with Reclamation’s focus on developing the basic infrastructure that supports the Real-Time Management Program (RTMP) for the LSJR. Reclamation has no ability or inclination to advise on stakeholder drainage release schedules and salinity management practices within the Basin. Rather Reclamation sees its role as facilitating effective and timely decision making using calibrated simulation models and other techniques to forecast River salt load assimilative capacity at Crows Landing and Vernalis compliance monitoring locations.¹ Two-week forecasts of salt load assimilative capacity have been suggested as a good compromise between model predictive uncertainty and stakeholders ability to undertake timely actions during periods of potential exceedance of the 30-day running average salinity at the two compliance monitoring locations. The updated MAA states that Reclamation actions will be described in an annual work plan. The annual work plan serves as a continuation of the work that was initiated in the Reclamation Action Plan.

The annual work plan summarizes annual planned activities to be conducted by Reclamation in conjunction with each element outlined in the Updated MAA.² This includes support of Phase 3 activities listed in the RTMP Framework document, approved by the CV Water Board in December 2014. The original Action Plan described Reclamation’s past practices and procedures to mitigate and manage adverse impacts of salt and boron imported into the SJR Basin via the DMC in order to help achieve compliance with the objectives contained in the CV Water Board’s “Water Quality Control Plan for the Sacramento and the San Joaquin River Basins– 4th Edition” (Basin Plan). Those actions were updated and added to the Updated MAA, and are now reported in the annual work plan and annual report.

In addition to Reclamation’s commitment to the real-time water quality (salinity) management program the agency performs a variety of salinity management activities within the San Joaquin watershed. Examples of these activities include participation in the Grassland Bypass Project (GBP), the WaterSMART Grant Program, the New Melones Plan of Operations, and the Westside Regional Drainage Plan. Reclamation has committed significant resources to the development of the real-time management pilot project in GWD because it serves as an exemplar

¹ An amendment to the Water Quality Control Plan for the Sacramento and San Joaquin River Basins was adopted by the CV Water Board on 6/9/17, approved by the State Water Board on 1/9/18, approved by OAL on 4/19/18, and pending approval by USEPA as of June 2018. Upon approval, the amendment will establish new WQOs for the San Joaquin River, Reach 83 (from the mouth of the Merced River to Airport Way Bridge) of 1550 micro Siemens per centimeter (uS/cm) during most years, and 2470 uS/cm during extended dry periods. During extended dry periods a maximum annual average of 2200 uS/cm will also apply. The amendment also includes an unenforceable performance goal of 1350 uS/cm. The existing WQOs of 700 uS/cm (April to August) and 1000 uS/cm (September to March) will remain in effect. Crows Landing and Maze Road Bridge will be the compliance points for the new WQOs. For the purposes of the RTMP, forecast efforts will focus on meeting the new WQOs at Crows Landing and the existing WQOs at Airport Way Bridge.

² The activities in the work plan are subject to the availability of a financial allocation.

not only to the adjacent State and Federal refuges but also, in its use of state-of-the-art sensor technology, advanced visualization and an enterprise-level hydrologic data management system, to other westside agricultural water districts in the Basin.

The primary purpose of the CV Water Board–approved RTMP is to implement salinity management activities not only to meet seasonal quantitative salinity objectives at Vernalis but also at the pending compliance monitoring station at Crows Landing. The pending Basin Plan amendment, establishing the Crows Landing compliance monitoring station, was undertaken to protect beneficial uses, including irrigation supply in the LSJR from the mouth of the Merced River to Airport Way Bridge near Vernalis. If approved by the U.S. Environmental Protection Agency, the Basin Plan amendment would take effect in January 2020. The RTMP is also designed to encourage export of surface-water salt loads in accordance with the provisions in the Basin Plan during times of high river assimilative capacity for salt, reduce the reliance on the New Melones Reservoir for dilution flows to the LSJR, and to establish an organizational approach for the continuing development, implementation, and coordination of the RTMP.

Reclamation, in response to the passage of the “Water Supply, Reliability and Environmental Improvement Act” (Public Law 108-361), which includes the California Bay-Delta Authority (CALFED), has initiated implementation of the Program to Meet Standards (PTMS). This program intends to provide greater flexibility in meeting existing water quality standards for the Central Valley Project (CVP). Reclamation currently utilizes the CALFED funding authorization for the PTMS, which includes the RTMP.

Reclamation Staff Resources

Table 1 lists Reclamation staff resources that are utilized at least in part for activities relating to the salt and boron control program on the LSJR.

Table 1. List of Reclamation Staff and hours/week dedicated to the RTMP

Agency	Staff Resource Name	Role (Approximate %Time in RTMP)
Reclamation	Vanessa Emerzian	PTMS Project Manager (50%)
Reclamation	Nigel Quinn	Technical Expert employed under contract with the University of California, Merced to Reclamation (40%)
Reclamation	Elwood Raley	Regional Water Quality Coordinator (50%)
Reclamation	Michael Eacock ¹	Natural Resource Specialist (25%)
Reclamation	Jun Wang	WARMF Modeler (50%)
Reclamation	Junaid As-Salek	Contracting Officer's Representative/Grant Officer's Technical Representative (15%)

¹Retired June 2018, replacement to be determined.

Goals and Objectives for FY 2019

All the activities and technical support planned for Fiscal Year (FY) 2019 are intended to provide resources, information, and support to LSJR stakeholders who wish to participate in the RTMP. Experience gained from the GWD pilot study will also be utilized to guide expansion of the program into other water districts, refuges, and entities in the SJR watershed.

Table 2. Reclamation Goals and Real-Time Management Program Phases 3 and 4 Elements

FY 2019 Goals	Associated RTMP Phase 3 or Phase 4 Element
<p>1. Continue funding and managing contracts to support and develop the WARMF-Online website for stakeholder use.</p> <ul style="list-style-type: none"> • Systech Water Resources, Inc. • 34 North Inc. (contract pending) • Cooperative Ecosystem Studies Unit (CESU) agreement with University of California at Merced for expert services from Dr. Nigel Quinn • Improvements to algorithms to add groundwater flow capability to west-side watersheds to improve small watershed simulation • Continued work to improve wetland simulations, account for seepage losses, and automate access to EC and flow data from wetland drainage outlets • Improve output visualization 	<p>[Phase 3 is defined in the Salinity Real-Time Management Program Framework, October 17, 2014, as the early implementation phase from March 31, 2015, to March 31, 2018].</p> <p>[Phase 4 is the implementation phase from March 31, 2018, to March 31, 2021]</p> <p>Phase 3 – One or more cooperating agencies or other RTMP participants to conduct programmatic weekly forecasting of salt load assimilative capacity in the SJR. Data sharing is of utmost importance to the successful implementation of the RTMP. In order to improve the accuracy of WARMF model output, key stakeholder members of the RTMP to share flow and water quality information throughout the basin.</p>
<p>2. Overwrite WARMF model sub-watershed simulation output with actual flow and EC data obtained from the RTMP stakeholders. Drainage discharge data, from districts such as Turlock Irrigation District (TID), need to be made available through the WARMF-Online web portal. Modesto Irrigation District (MID) proposed that their operational spill data will be made available monthly in a format compatible with the district's existing database software. Combined drainage flow and EC data from GWD will be aggregated into a single salt load estimate at a virtual station. This goal was included in the FY 2018 work plan but was not fulfilled owing to the disruption caused</p>	

<p>by the loss of the YSI-EcoNET web portal and real-time web access to the drainage data at all five outlets. Web access to these stations will be restored with new project funding in FY2019 and this important project goal will be completed soon after in FY 2019. Reclamation will continue to work with the RTMP and its stakeholders to develop real-time drainage data quality assurance (QA) using WISKI or similar software tools. Reclamation has experience with solutions for real-time data quality assurance using the hydrological data management software WISKI. This software is being used by Merced and Turlock Irrigation Districts, and was installed in GWD in 2015. However this hydrological data management software may be too complex and onerous for smaller districts. More straight-forward data screening options are being explored with two of the hardware vendors with the possibility that a first pass of data screening may be built in to future dataloggers. This is unlikely to be fulfilled in FY2019 however if development is successful it may be available in FY 2020.</p>	
<p>3. Assess WARMF model accuracy at simulating flow, EC and salt load at Vernalis and at Crows Landing compliance monitoring stations. In addition Reclamation will assess the “skill” of salt load assimilative capacity 14-day forecasts by comparing forecast flow, EC and salt load assimilative capacity with observations (2 weeks later). Reclamation has recognized the need for stakeholder involvement for making forecasts since the onset of the RTMP – however communication with west-side and eastside contractors was very ad-hoc and no system had been developed to receive this information on a routine basis. When necessary, Reclamation will work directly with the RTMP Steering Committee to obtain needed data. Since Feb 2018 on the suggestion of one of the Reclamation team members, we have explored the use of routine 5-day flow forecasts for the major tributaries and certain stations along the main stem of the SJR as an initial basis for the 14-day forecast. It turns out that the River Forecasting Center (RFC) supplies inflow forecasts to the operators of the</p>	

<p>major east-side reservoirs who in turn provide the RFC with anticipated flow release schedules. These flow release schedules are far more accurate than the long-term average flow releases estimated by the WARMF model. This has led to a significant improvement in the short-term flow forecasts. Various techniques, described in other sections provide details of the various techniques being explored to develop salinity and salt load assimilative capacity forecasts from these 5-day flow forecasts. By the end of FY2019 we anticipate that this initiative will progress to an enhanced 14-day salt load assimilative capacity forecast.</p>	
<p>4. Hold technical research team (TRT) meetings in Sacramento, Los Banos, and/or Modesto to facilitate stakeholder participation. The last TRT meeting was held on August 7, 2018. The previous TRT meeting was held on May 24, 2017, and were planned to continue on a monthly/as-needed basis. However, the TRT schedule has been impacted by personnel changes within Reclamation and contractual difficulties. Another factor has been the advice from the San Joaquin Valley Drainage Authority (SJVDA) that we only hold these meetings when there is sufficient material to share and discuss to warrant a meeting- given the time pressure on water district managers and the great number of existing meetings on their respective calendars. TRT presentations are being coordinated with the SJVDA. These will also be coordinated with the RTMP Steering Committee and the LSJR Committee, if it is revived, because these committees typically attract many of the stakeholder water districts discharging to or diverting from the SJR. Hence all future TRT meetings will be broadened to include East-side districts such as MID and TID to encourage more active engagement.</p>	<p>Phase 3 – The RTMP to develop and recommend specific additional management practices, monitoring stations, and data delivery requirements needed to better coordinate the real-time operation of discharges to the LSJR.</p>
<p>5. Continue to provide technical support as needed. Examples of technical support include assistance with design and operation of monitoring stations, telemetry, data collection protocols, data management, visualization of data, data security and sharing in real-time. As indicated in the FY</p>	

<p>2018 Annual Report, solutions were found to replace the YSI EcoNet system. Two candidate environmental monitoring equipment and software vendors have been identified that can provide superior sensor web capabilities and replace the obsolete YSI-EcoNET system in GWD. These new systems will be recommended for new environmental sensor installations.</p>	
<p>6. Continue the effort to gain access to real-time east-side SJR flow and EC data for use in the WARMF forecast model. TID is cooperating, however the District changed its mind in early 2018 with respect to the way data is provided - moving away from sending drainage and spill data directly to the WARMF-Online and now hosting an external ftp site where Reclamation has been granted read and download access. The District has restored EC monitoring at each of their drainage outlets and this data is being included on their external ftp site. MID has also indicated a willingness to share flow and EC data from their operational spills into the Stanislaus and Tuolumne Rivers, but will require implementation of additional quality control and data transfer protocols before making data available directly to the WARMF-Online. We anticipate this issue will be resolved by early FY2019. Unlike TID, MID has continued to service its EC sondes and should be able to provide historical data once the data sharing protocols have been established. The State and Federal refuges have been contacted to encourage more active involvement and commitments to data sharing. New grant funding may increase the number of stations in the State and Federal refuges. Buttonwillow Lake (the major drainage outlet for the Los Banos Wildlife Management Area Wetland) return flows constitute an increasing proportion of salt loading to the SJR especially in dry and critically dry years when water deliveries to south-of-Delta contractors can be reduced by 75% or more while wetland entities may still receive a 100% water supply.</p>	<p>Phase 3 – The RTMP to work with its coalition, irrigation and water districts, State and Federal wetlands, and other members to obtain real-time data needed for model success.</p> <p>The RTMP to continue outreach for additional stakeholders in the LSJR sub-basins.</p>
<p>7. Reclamation provided technical support in the writing of grant applications submitted by GWD and SJVDA in 2016 under the Prop 84 grant</p>	<p>Phase 3 – The RTMP participants will analyze the need for additional infrastructure and identify</p>

<p>program to the California Department of Water Resources (DWR). Both grants addressed the upgrade of existing real-time monitoring site infrastructure. The SJVDA grant proposal includes the eight west-side monitoring stations that were supported by an equipment grant in 2003 from the CV Water Board. The existing equipment at these sites, and many installed by GWD, is obsolete. The grants were approved in 2017 but withdrawn later that year owing to accounting irregularities under a prior grant by one of the grant recipients. The intention to provide funding (at a reduced level) was received in May 2018. It is anticipated that site rehabilitation work under these grants will begin in early FY2019.</p>	<p>necessary funding requirements through the MOU.</p>
<p>8. Reclamation has indicated a commitment to maintain 3 of 5 stations currently monitored by the U.S. Geological Survey (USGS) under Reclamation contract. Reclamation is actively working with GWD to explore expanding their existing monitoring network to include, the stations Crows Landing, Mud Slough, and Salt Slough (Newman and Fremont Ford are not considered critical for the RTMP). There are distinct advantages with having a stakeholder entity take over monitoring of the important Mud Slough and Salt Slough monitoring sites as follows: (a) With the sunset of the GBP and the diminution of flow and salt loading from the Grassland Drainers – Mud and Salt Slough are increasingly dominated by wetland drainage and salt loads; (b) GWD has a significant interest in actively sharing the salt load data with the State and federal Refuges as a first step to better coordination of wetland salt load management; and (c) Stakeholders meet regularly in other venues and are more likely to settle upon an effective technique for data sharing and stakeholder decision support techniques.</p>	
<p>9. Ask the RTMP to encourage High and Medium Priority level participants to utilize the results of WARMF model forecasts to coordinate the timing of salt loading to the River, especially during periods of low salt load assimilative capacity. A new initiative, begun in Spring 2018, has looked</p>	<p>Phase 4 – Implementation Phase</p>

<p>into simplifying the model forecasting process using Artificial Neural Network and regression techniques as well as improving model forecast output visualization. Initial success has been realized using short-term (5-day) flow forecasts made by the River Forecast Center and a simple inverse relationship between flow and EC at the compliance monitoring stations. Although this technique does not provide information on the major sources of salt loading to the River it does appear to offer a promising alternative to the more mechanistic WARMF forecast modeling approach. Ongoing work in 2018 will develop protocols for extending the model forecasts of flow, EC and salt load assimilative capacity to 14 days. A 14 day forecast period was recommended by the Central Valley Salinity Alternatives for Long-Term Sustainability (CV-SALTS) LSJR Committee as a minimum that allows stakeholders to modify operations in response to a potential 30-day running average EC violation at the Vernalis or Crows Landing compliance sites.</p>	
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The goals for FY 2019, listed above, include improvements and refinements to the existing WARMF LSJR forecast model with emphasis on ease of use, automation of data inputs, and visualization of both data input and WARMF model output.

With the prospect of having future secure access to a Reclamation cloud server – initial discussion is underway to scope out eventual hosting of east-side salinity drainage data on the Reclamation Cloud. This would significantly reduce the cost of serving this data to the stakeholder community and those running weekly or daily forecasts however there would be some residual cost for maintaining the data, performing basic data quality assurance and backing up the data.

Improving access to real-time data from eight west-side drainage stations located within Patterson and West Stanislaus Irrigation Districts and El Solyo Irrigation District (ESID) has been a high priority for several years. The WARMF model has been structured to be able to accept these inputs directly and overwrite the drainage estimates made by the model’s internal watershed runoff algorithms. The WARMF-Online web portal has also been structured to upload these data to provide the data sharing capabilities it was designed to perform and for inclusion in WARMF-based salt load assimilative capacity forecasts. The eight west-side drainage stations are Moran Drain, Marshall Road Drain, Spanish Land Grant Drain, Ramona Lake Drain, Del Puerto Creek, Westley Wasteway, Ingram Creek, and Hospital Creek. The grant will pay for upgrades of the sondes, dataloggers, and telemetry hardware at all sites using hardware supplied by either In-Situ Inc. or SUTRON Inc., both of which allows low-cost web access to real-time data using the web portal. Both equipment vendors have incorporated Bluetooth capabilities in

their sondes and sonde-communication cables allowing much easier retrieval of the data while in the field and allowing the sensor QA protocols to be carried out in the field much faster. GWD has deployed both InSITU and SUTRON dataloggers and currently reports monitoring site data to both web portals in their drive to replace obsolete YSI-EcoNET technology that was mothballed in April 2017. At present the five GWD drainage sites utilize the new SUTRON technology and the HyrdoNET Cloud web portal while the internal and inflow sites utilize the InSITU technology and the HydroVu Cloud web portal. Advantages of both In-Situ and SUTRON technologies are low cost, ease of programming, compatibility with MACE acoustic Doppler hardware (in the case of InSITU which purchased the company), and access to a web portal owned by the vendor at minimal cost (for cellular data charges). It is envisaged that these upgrades in 2018 and 2019 will improve water district interest and “ownership” of the data produced at the eight drainage sites, and make sharing of this data much easier.

There is a need for real-time data quality assurance prior to its use in the WARMF forecasting model. The standard enterprise-level solution for larger water districts and institutions such as TID and Merced Irrigation District is the hydrologic data management software (Kisters Inc.) WISKI. WISKI is a powerful analytical and data processing tool used around the world and capable of providing automated, real-time data QA. The software is capable of automating the filling in and extrapolating data, setting flags for inconsistent data, fitting cubic splines, annotating changes to the original data signal and data reporting. The software also performs curve shifts and other data conditioning to provide a best fit to observed flow and EC data reported from the field. GWD is a relatively new user of this software since 2015. SUTRON Inc. is developing some basic QA functionality on its web portal which may provide an easier solution than adoption of the WISKI software. Reclamation will work with software vendors SUTRON and in-SITU during FY2019 and will be in a position to beta-test any innovations worth considering as long-term solutions for smaller districts and entities that cannot afford the expense or time commitment of deploying enterprise-level software like WISKI.

One of the most important remaining limitations to the ability to forecast salt load assimilative capacity in the SJR will be overcome with real-time access to SJR diversion data – primarily the pumping stations operated by Patterson Irrigation District (PID), West Stanislaus Irrigation District (WSID) and ESID – which together account for more than 80% of the riparian diversions from the SJR. Discussions were initiated with these stakeholders in early 2017 through quarterly meetings of the Westside San Joaquin River Watershed Coalition (WSJRW) held under the auspices of the SJVDA. As previously noted - real-time monitoring of the PID and WSID diversions are included in the Proposition 84 grant funding to the SJVDA. Assuming the contracting for these funds is completed successfully by September, 2018, real time data access to these stations for salt load assimilative capacity forecasting may be achieved in late 2019. No other sources of funds appear likely. The CV Water Board indicated that despite including the RTMP as one of the priority areas in their FY 2018 RFP, the RTMP is and will likely remain ineligible. Proper accounting for river diversions will have a very positive impact on the ability to perform accurate forecasting of salt load assimilative capacity. The current RFC forecasts made for the SJR and its major tributaries do not account for river diversions – hence inclusion of these data and real-time access diversion forecast information from the diverters will further improve salt load assimilative capacity forecasts at both Crows landing and Vernalis compliance monitoring sites. Real-time monitoring of River diversions is a Phase 3 activity which will be operational during Phase 4 of the current Work Plan.

Provision and sharing of real-time flow data will also provide an opportunity to interact more cooperatively and share data with the SJR Restoration Program, which performs real-time water management along the middle SJR between Friant Dam and the SJR confluence with the Merced River. The SJR station at Lander Avenue provides boundary inflow information for the WARMF-SJR model. Unfortunately, this site is a poor one for flow and EC data (particularly flow). Better estimates and operational forecasts are made weekly by Restoration Program staff, and these improved flow estimates will be used to overwrite current extrapolated flow data, especially at the upstream Lander Avenue station model boundary. The Restoration Program is interested in the EC of water diverted from the PID, WSID, and ESID since Restoration flows are allowed to be recaptured between the Merced confluence and Vernalis, and reused. Both programs can gain by greater cooperation and coordination. Remaining constraints to this coordination and cooperation will be addressed during Phase 4 of the program in 2019. Cooperation and coordination for future monitoring of SJR Lander Ave flow and EC may result in the recommendation to move the site upstream or downstream to a location that is accessible, has a narrow and uniform cross section and that is well mixed for representative EC measurements.

One significant breakthrough in forecasting skill was made in early 2018 through the use of forecast information from the National Oceanic and Atmospheric Administration RFC. Although the RFC mission is to provide the most accurate stage forecasts in major Rivers in the State that occasionally carry flood flows - current flow ratings allow the conversion of River stage to flow. The RFC coordinates with Irrigation District operators of the major reservoirs along the Merced, Tuolumne and Stanislaus Rivers – providing these operators with their estimates of reservoir inflow from rivers and streams draining the Sierra Nevada. These operators, in turn, alert the RFC and provide their release forecasts which provide the best estimate available of flow at the downstream flow monitoring locations of the Merced, Stanislaus and Tuolumne Rivers. River forecasts along each river are adjusted by the RFC to match the flows at the downstream flow gauging sites. Although the Ripon and Modesto gauging stations are in excess of 10 miles upstream of the confluences with the SJR – they are expected to provide flow estimates within 10% of the discharge to the SJR. The major limitation of RFC forecasts are that they are for flow only, neglecting EC and also that they extend in time only 5 days rather than the 14-days required by the RTMP. New work will be undertaken in late 2018 and 2019 to work directly with Reservoir operators to obtain extended forecasts for each SJR tributary beyond the 5-day RFC forecast. Regression relationships that have been used in the past to relate flow and EC along each tributary will be updated to provide the extended tributary forecasts of EC and improve the accuracy of the salt load assimilative capacity forecasts at both Crows Landing and Vernalis. The salt load assimilative capacity forecasts will utilize the 30-day running average EC in addition to the daily mean EC in the weekly (daily) updates posted online.

The Lawrence Berkeley National Laboratory (LBNL), via the University of California Merced, will continue model evaluation and development activities to improve the accuracy of the model at simulating flows and salt loads generated at the sub-watershed level. The work will focus on the eight west-side drainage stations (listed above) and the managed wetland entities; improved model accuracy should promote stakeholder acceptance of the WARMF forecast. It should be clear that the model simulates drainage return flows and salt loads when real-time data is not available from stakeholders for direct substitution into the model. This is the ultimate goal of the program — to encourage stakeholders to invest in the program by facilitating access to real-time

data and providing resources to maintain the stations located in their districts to ensure that the real-time data transmitted to WARMF-Online and the WARMF forecasting model is reliable. A further benefit to having access to all available data is that the modeling approach can be simplified considerably and perhaps eventually reduced to a spreadsheet architecture. The WARMF model based approach was adopted originally because watershed hydrology had to be simulated to provide drainage return flow estimates in lieu of real-time data. Migrating to a data driven accounting model architecture will have the added benefit of making the forecasting process more transparent and help to increase stakeholder confidence. Stakeholders tend to take more interest and become less skeptical when their data is being used directly in the computation of flow, EC and salt load assimilative capacity.

Reclamation has continued to participate in the CV-SALTS stakeholder group as a member of the Executive Committee and the LSJR Committee. Continued coordination with CV Water Board staff will be necessary during the implementation of newly adopted water quality objectives (WQOs) for the LSJR, and other Basin Plan amendments, as appropriate.

Reclamation will also continue to operate the New Melones reservoir according to State Water Board water rights stipulations to ensure that salinity standards specified at Vernalis in Revised Water Right Decision 1641 (State Water Board, March 15, 2000) are not exceeded.

On June 9, 2017, the CV Water Board adopted an amendment to establish salinity WQOs in the LSJR upstream of Vernalis and reduce reliance on New Melones Reservoir water releases to meet salinity water quality objectives at Vernalis.

On January 9, 2018, the State Water Board approved the CV Water Board's amendment. The California Office of Administrative Law approved the amendment on April 19, 2018. The U.S. Environmental Protection Agency is currently considering approval.

The new WQOs for the LSJR will be evaluated to ensure that they meet their intended purpose as described, in part, in the State Water Board's approving resolution (Resolution No. 2018-0002).

Funding and Status of the Monitoring Program

Table 3. FY 2019 Proposed Funding from Reclamation sources

No.	Funding Program	Year	Allocation/Yr	In Kind
I.	34 North Inc. 1. Technical support for hosting and portal maintenance 2. Upgrade of the web portal graphical user interface 3. Platform enhancements 4. Stakeholder dashboards and support 5. Third Party data management 6. Participate TRT meetings	2017 through 2020	\$750,000	\$200,000
	Systech Inc. 1. Technical support 2. Upgrade of the WARMF graphical user interface 3. Data analysis of SJ River seepage losses and update simulation engine 4. Refinement of WARMF catchment boundaries and update groundwater recharge simulation in Grassland Subarea 5. Documentation of the SJ River WARMF application 6. Active Participation in Meetings	2017 through 2019		
	Expert Technical Services, Berkeley National Laboratory through University of California, Merced CESU agreement	Annually		
	Reclamation Staff Resources	2019		
II.	Grassland Bypass Project ¹	2017-2019	\$860,000 ²	NA
III.	WaterSMART Program ¹	2019	TBD	NA
IV.	Westside Regional Drainage Plan ¹	2016-2019	\$3.8 million estimated	NA
¹ The funding allocation is not specifically a PTMS allocation but yields salinity benefits in the SJR. ² Allocation includes \$200,000 annually to USGS to monitor five stations on the LSJR and tributary sloughs.				

Funding amounts listed in Table 3 are subject to allocation and are to be considered estimates until allocations have been completed. The PTMS allocation is utilized to fund Reclamation activities directly related to salinity in the SJR. The GBP and WaterSMART Program also provide salinity management benefits to the SJR, and are listed accordingly in Table 3.

A major concern is the loss of funding in 2019 for the operation and maintenance of five stations (Mud Slough, Salt Slough, Crows Landing, Newman, and Fremont Ford) that are currently being monitored by the USGS. It was announced in June 2017 that this funding would expire due to the sunset of the GBP. A concerted effort is underway to obtain long-term support for operation and maintenance of three of these monitoring stations – Mud Slough, Salt Slough and Crows Landing – that are critical to the real-time monitoring program as well as to CV-SALTS and the CV Water Board for salinity compliance monitoring. A local stakeholder entity is under consideration to take over the operation and maintenance of these stations. This has the potential to reduce costs associated with this monitoring (currently estimated at \$40,000 per station per year) while providing an opportunity for stakeholders to pay more attention to the manner salt load assimilative capacity is assessed and how it may be manipulated to ensure long-term compliance with River salinity objectives (see Table 4 for the status of monitoring stations).

Table 4. Status of monitoring stations on the LSJR and on the west side of the SJR Basin directly supported by Reclamation and the SJVDA

Station Description¹	Status
Salt Slough at Highway 165 (near Stevenson) ^a	Active – currently reporting to National Water Information System (NWIS)/California Data Exchange Center (CDEC) (operated by Reclamation/USGS).. Site potentially operated by stakeholder entity after Oct 2019 /USGS)
Mud Slough near Gustine (GBP Site D) ^a	Active – currently reporting to NWIS/CDEC (operated by Reclamation/USGS).. Site potentially operated by stakeholder entity after Oct 2019 /USGS)
Mud Slough above San Luis Drain Confluence (GBP Site C) ^b	Sampling location; not a monitoring site. Data collected by SJVDA
San Luis Drain at Outlet (GBP Site B) ^b	Active – operated by SJVDA
Los Banos Creek at Highway 140 ^c	Active (operated by GWD reported to GWD HydroVu web portal)
SJR at Newman ^a	Active – reported to CDEC (operated by Reclamation/USGS). Likely sunset after Oct 2019.

Station Description¹	Status
Marshall-Spanish-Moran Drains ^c	Inactive – telemetry needs upgrading (operated by SJVDA). Site to be rehabilitated under Prop 84 funding
Ramona Lake ^c	Inactive – telemetry needs upgrading (operated by SJVDA). Site to be rehabilitated under Prop 84 funding
Orestimba Creek near River Road, Crows Landing ^a	Inactive. Sites abandoned by USGS.
Westley Wasteway ^c	Inactive – telemetry needs upgrading (operated by SJVDA). Site to be rehabilitated under Prop 84 funding
Del Puerto Creek ^c	Inactive – telemetry needs upgrading (operated by SJVDA). Site to be rehabilitated under Prop 84 funding
Hospital Creek ^c	Active – reporting to CDEC (operated by SJVDA)
Ingram Creek ^c	Active – reporting to CDEC (operated by SJVDA)
SJR at Fremont Ford	Active – reported to CDEC (operated by Reclamation/USGS). Likely sunset after Oct 2019.
SJR near Patterson ^d	Active – reporting to CDEC (operated by DWR)
SJR at Maze Road bridge ^d	Active – reporting to CDEC (operated by DWR)
SJR near Crows Landing ^a	Active – reporting to NWIS/CDEC (operated by Reclamation/USGS).. Site potentially operated by stakeholder entity after Oct 2019.
¹ Stations are referenced from the 2014 SJR RTMP Framework Document. (a) Stations maintained by the USGS under contract with Reclamation (b) Stations monitored for the GBP by the San Luis and Delta-Mendota Water Authority (c) Station monitoring supported by Westside San Joaquin River Watershed Coalition (maintenance) and Reclamation (upgrades and troubleshooting) (d) Stations maintained by DWR	

References

State Water Board D-1641	Implementation of Water Quality Objectives for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; A Petition to Change Points of Diversion of the Central Valley Project and the State Water Project in the Southern Delta; and A Petition to Change Places of Use and Purposes of Use of the Central Valley Project. State Water Resources Control Board, March 15, 2000.
CV Water Board 2004a	Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for the Control of Salt and Boron Discharges into the Lower San Joaquin River Draft Final Staff Report Appendix 1: Technical TMDL Report, Regional Water Quality Control Board Central Valley Region, July 4, 2004.
CV Water Board 2017	Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins to add Electrical Conductivity Water Quality Objectives in the San Joaquin River Between the Mouth of the Merced River and the Airport Way Bridge Near Vernalis. Regional Water Quality Control Board Central Valley Region, June 9, 2017.
Basin Plan	1994 Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins, Fourth Edition, California Regional Water Quality Control Board Central Valley Region, updated April 2016.
Reclamation Action Plan 2008	Reclamation's Salinity Management Plan, Actions to Address the Salinity and Boron Total Maximum Daily Load Issues for the Lower San Joaquin River, July 2008 (Updated in November 2010).
Compliance Plan 2010	Compliance Monitoring and Evaluation Plan in Compliance with the "Management Agency Agreement between the Central Valley Regional Water Quality Control Board and the Bureau of Reclamation" executed on December 22, 2008; May 2010.
Compliance Report 2010	Compliance Monitoring and Evaluation Report, FY 2000 to Present in Compliance with the "Management Agency Agreement Between the Central Valley Regional Water Quality Control Board and the Bureau of Reclamation" executed on December 22, 2008; May 2010.
Management Agency Agreement, 2008 and 2014	Management Agency Agreement Between the Central Valley Regional Water Quality Control Board and the United States Bureau of Reclamation, Mid-Pacific Region. A Cooperative Means of Implementing Relevant Provisions of the Regional Water Board's Water Quality Control Plan for the Sacramento River and the San Joaquin River Basins – 4 th Edition, executed in December 2008 and updated in December 2014.